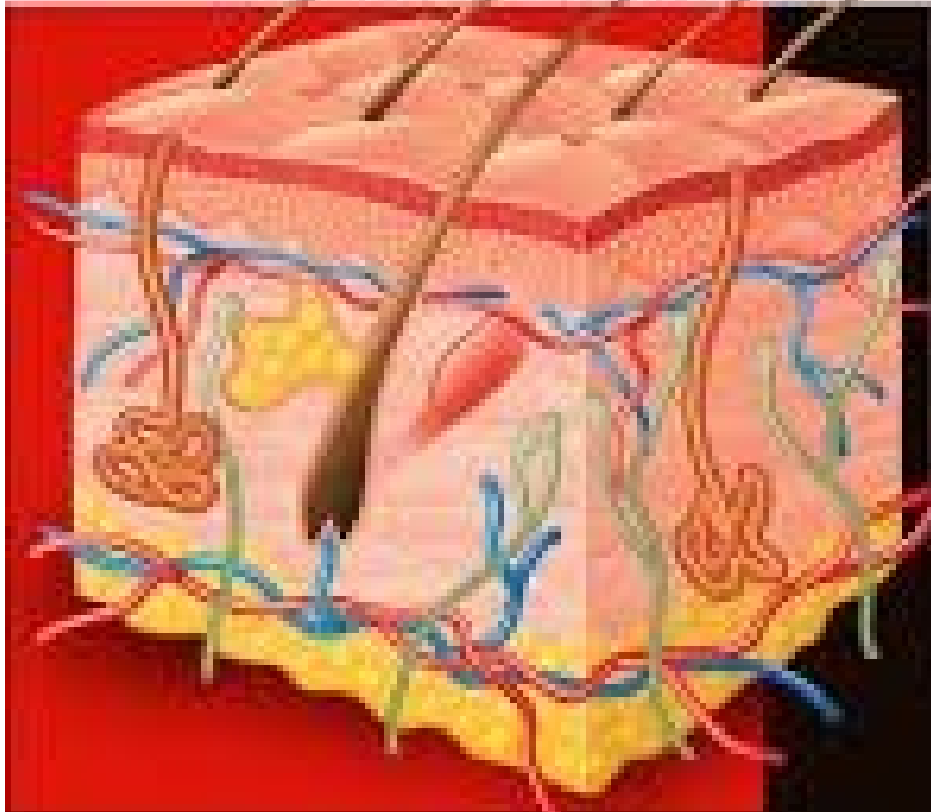


# INTEGUMENTARY SYSTEM

The Integumentary system consists of

- Hair
- Skin
- Nails
- Glands



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# THE SKIN

This extraordinary organ system :

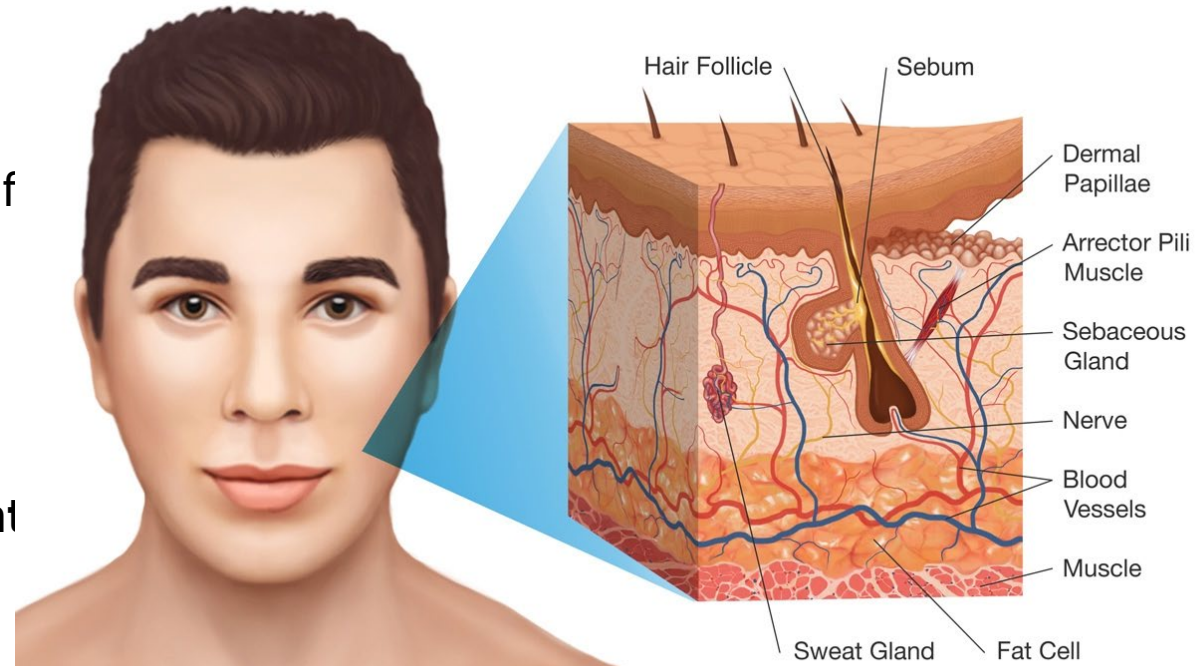
- ❖ Protects the internal structures of the body from damage
- ❖ Prevents dehydration
- ❖ Stores fat
- ❖ Produces vitamins and hormones.
- ❖ Helps to maintain homeostasis within the body by assisting with the regulation of body temperature and water balance.

- ❖ It is the body's first line of defense against bacteria, viruses, and other pathogens.

- ❖ It helps to provide protection from harmful ultraviolet radiation.

- ❖ The skin is a sensory organ with receptors for detecting heat and cold, touch, pressure, and pain.

- ❖ The natural secretion of sebum from the millions of sebaceous glands, each associated with a hair follicle, is slightly oily and furnishes the skin with **partially water-repellent and antibiotic qualities.**



# **TOGETHER, SKIN, HAIR, AND NAILS ARE KNOWN AS THE INTEGUMENTARY SYSTEM.**

- ❖ **The skin is the largest organ in the body, weighing 6–9 pounds and with a surface area of almost 21 square feet.**
- ❖ **Its thickness varies from about 1/50 inch on delicate areas such as the eyelids, to 1/5 inch or more on areas of wear and tear, such as the soles of the feet.**
- ❖ **Few body parts renew as rapidly as the skin.**
- ❖ **Every month the outer layer of epidermis is completely replaced, at a rate of 30,000 flake-like dead cells every minute.**
- ❖ **The journey from epidermal base to surface takes about four weeks, and a typical person sheds more than 1 pound of skin every year !!**
- ❖ **Dead skin cells combine with other particles to create household dust. The average home in the United States collects 40 pounds of dust each year !!**

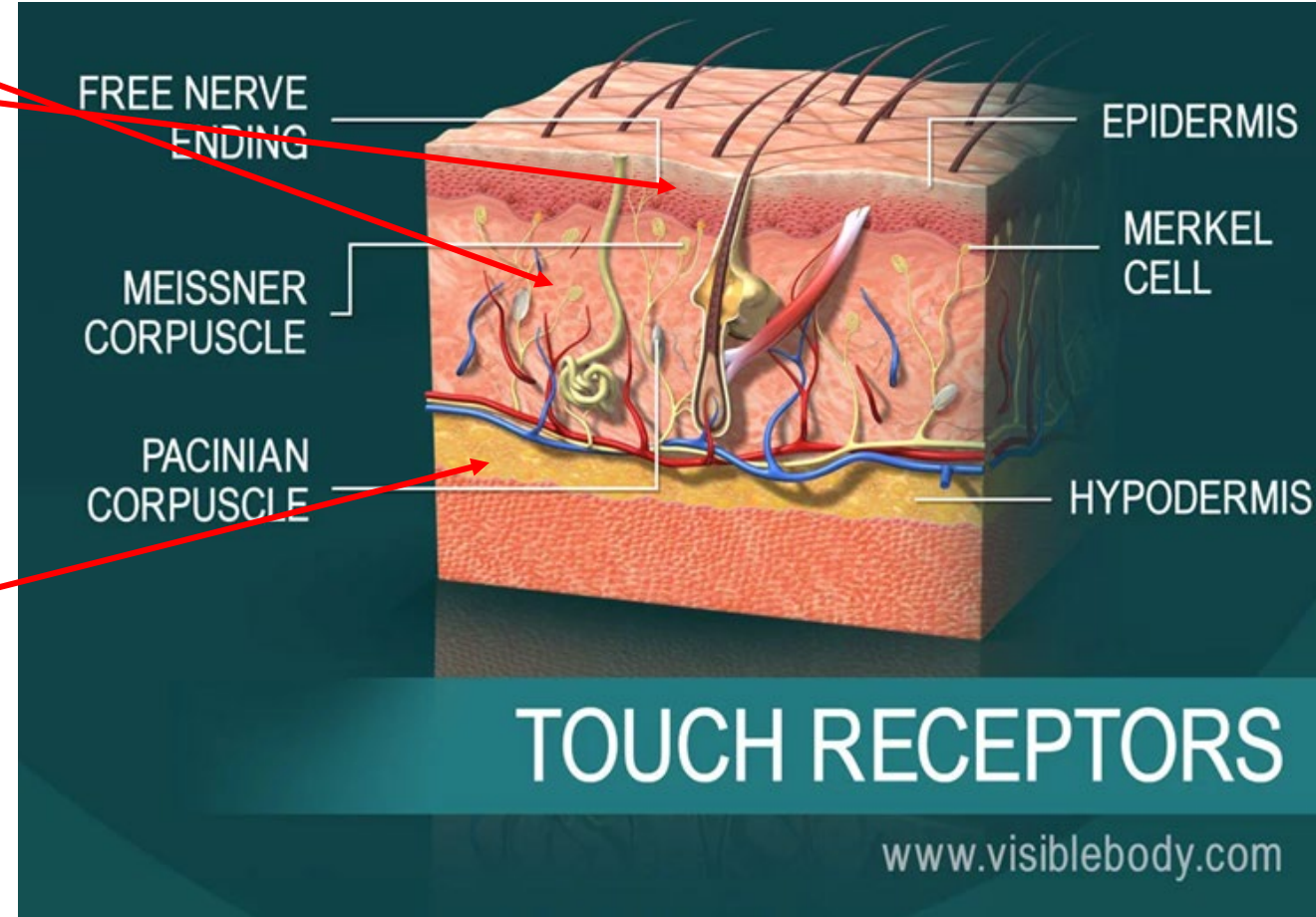
## Skin has two main structural layers.

The outer **Epidermis is chiefly protective**, and the underlying **Dermis** contains many different tissues with varied functions.

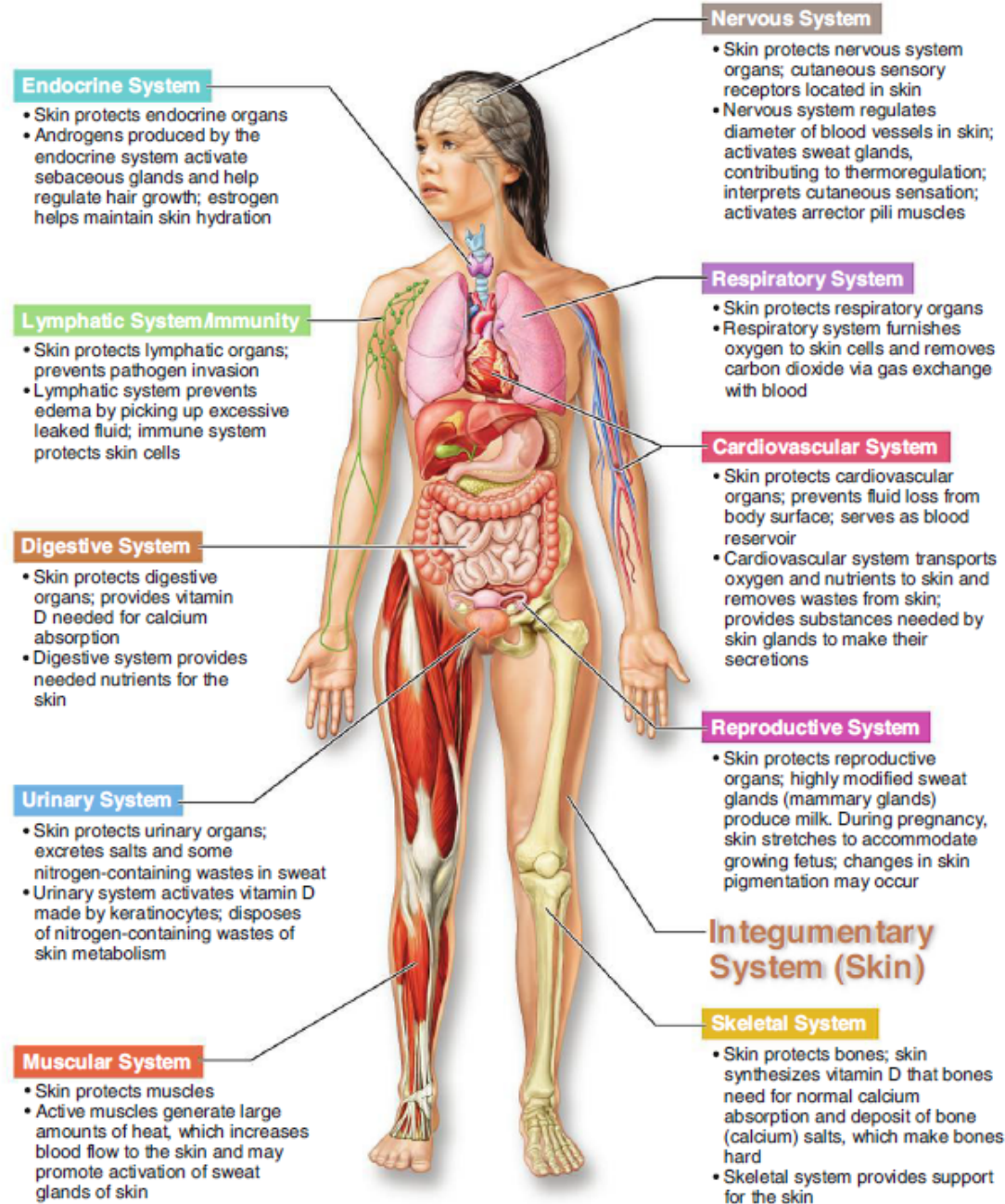
The **Dermis** contains thousands of microensors that enable the sense of touch, as well as sweat glands and adjustable blood vessels that contribute to **body temperature regulation**.

Under the dermis is a layer, sometimes regarded as part of the skin, called the **Hypodermis** and is made of subcutaneous fat.

This layer acts as a buffer and provides extra thermal insulation against extreme heat and cold.



# Homeostatic Relationships between the Integumentary System and Other Body Systems



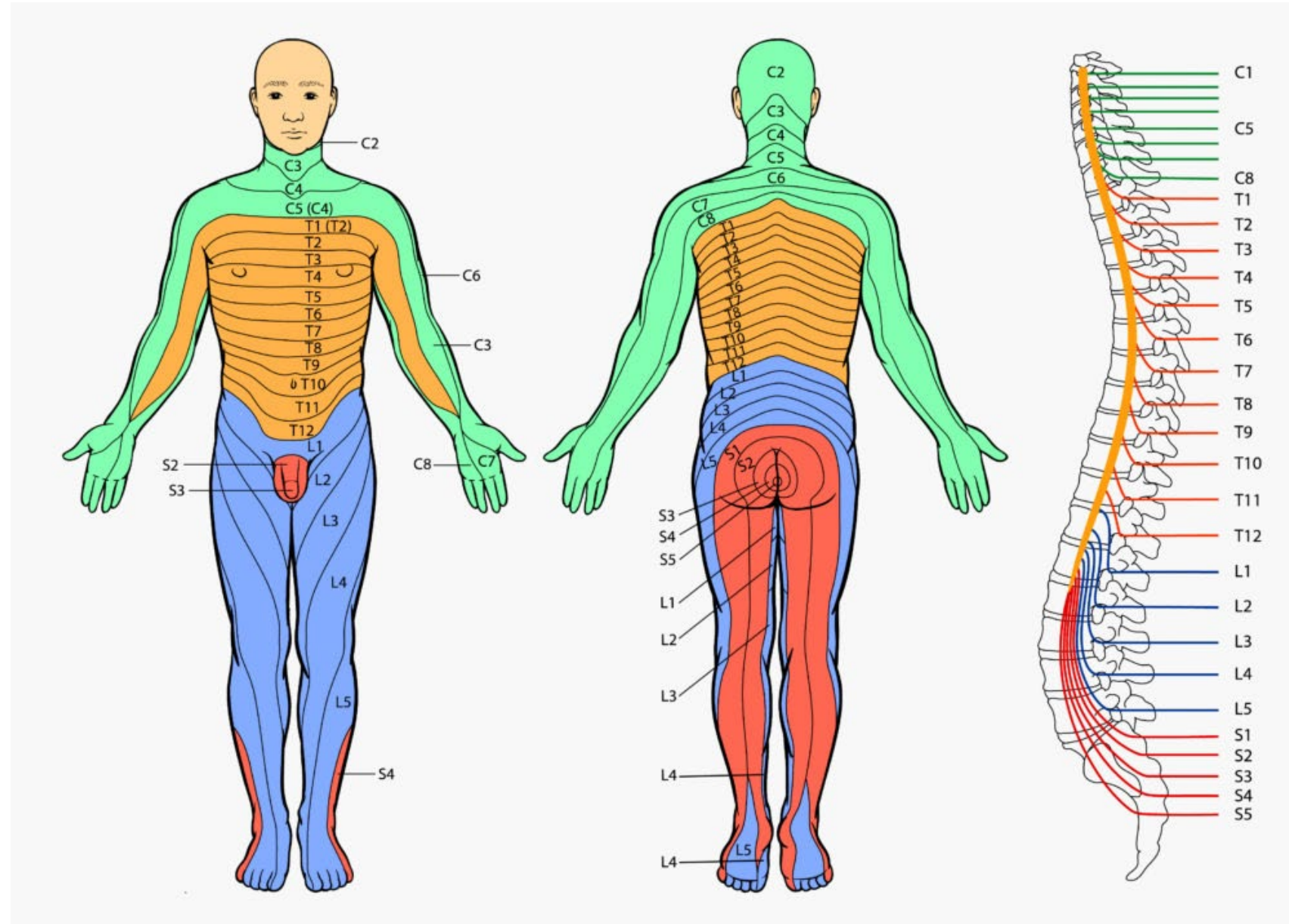
# Dermatomes

A dermatome is a region or zone of skin supplied by the dorsal (rear, sensory) nerve roots of one pair of spinal nerves.

The nerve branches carry sensory information about touch, pressure, heat, cold, and pain from the skin microensors within the zone, along the sensory nerve fibers of the branches of the spinal nerve, to the spinal nerve root and then into the spinal cord.

A "skin map" delineates these skin zones, or dermatomes.

In real life, the distribution of nerve roots, and so of sensations, overlaps slightly.



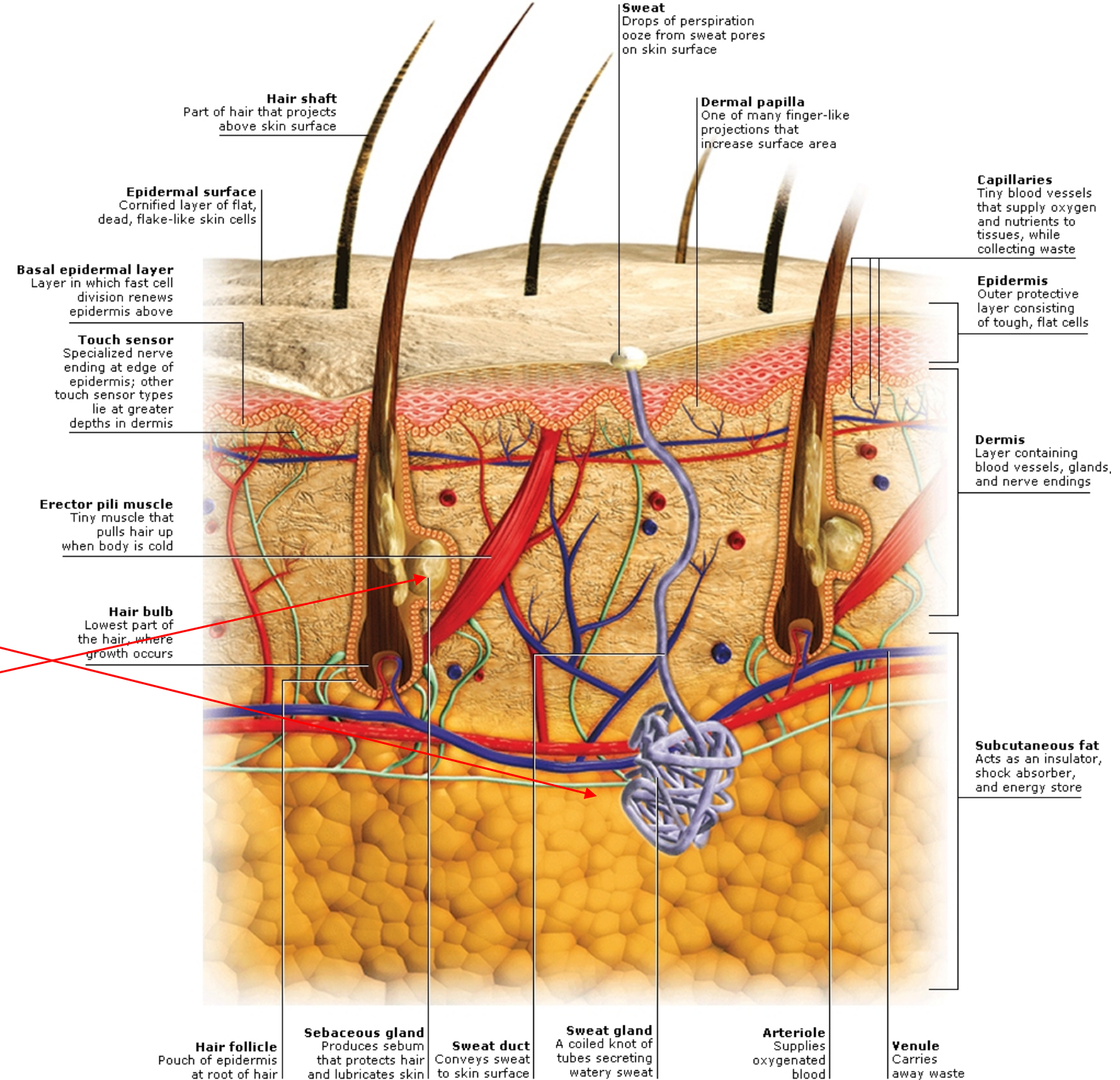
A patch of skin about the size of a fingernail contains 5,000,000 (5 million) microscopic cells of at least a dozen main kinds:

100 sweat glands and their pores

1,000 touch sensors

100-plus hairs with their sebaceous glands

Up to 3-1/3 feet of tiny blood vessels and about 1-2/3 feet of nerve fibers.

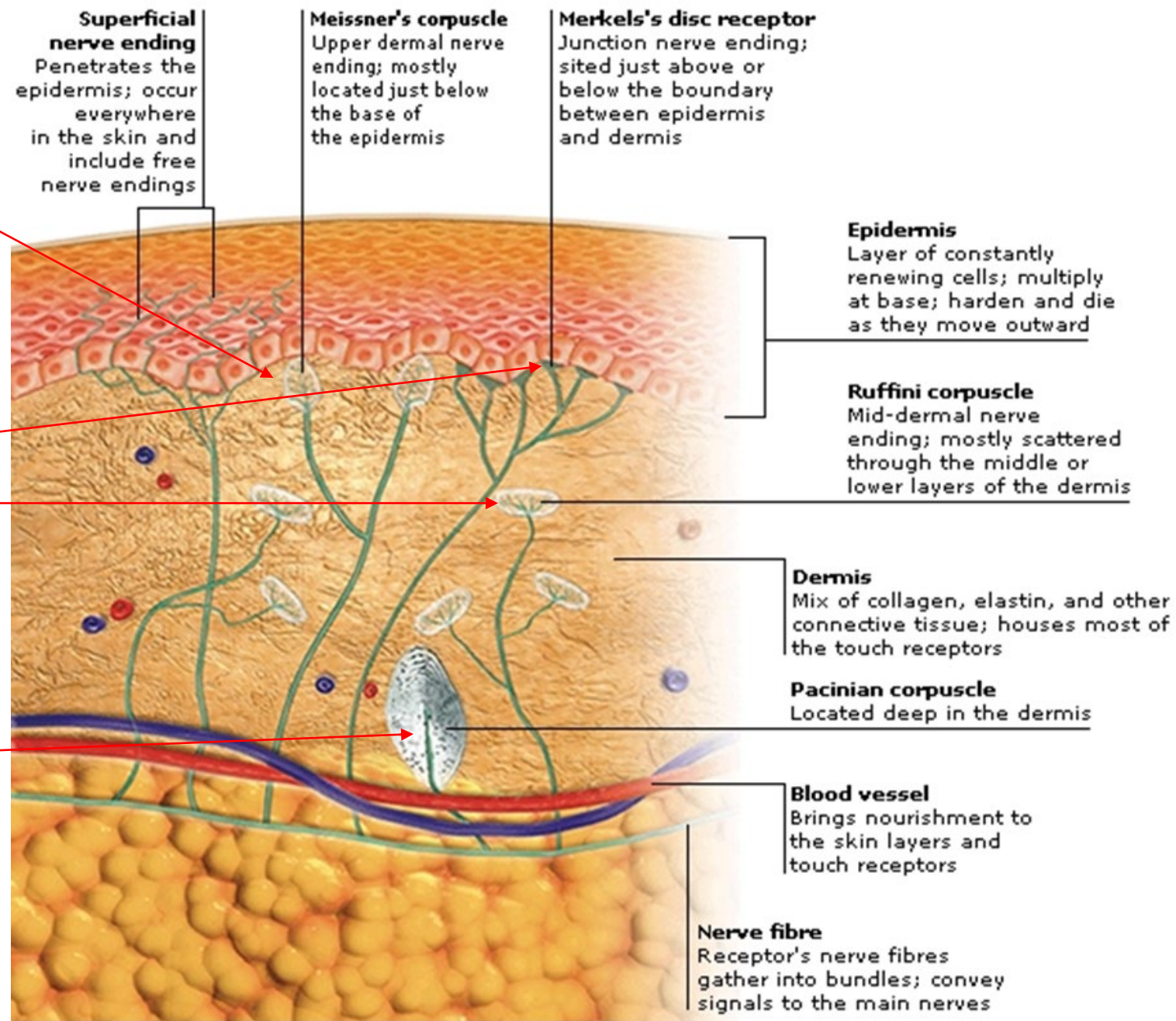


**Meissner's corpuscle** Encapsulated nerve ending in the skin's upper dermis, especially on the palms, soles, lips, eyelids, external genitals, and nipples, respond to light pressure.

**Merkels's disc** Receptors, usually in the upper dermis or lower epidermis, especially in non-hairy areas. They sense faint touch and light pressure.

**Ruffini corpuscle** Encapsulated receptor in the skin and deeper tissue that reacts to continuous touch and pressure. In joint capsules, it responds to rotational movement.

**Pacinian corpuscle** Large, covered receptor located deep in the dermis, as well as in the bladder wall, and near joints and muscles. It senses stronger, more sustained pressure.





# HOW A SKIN INJURY GETS REPAIRED BY THE BODY

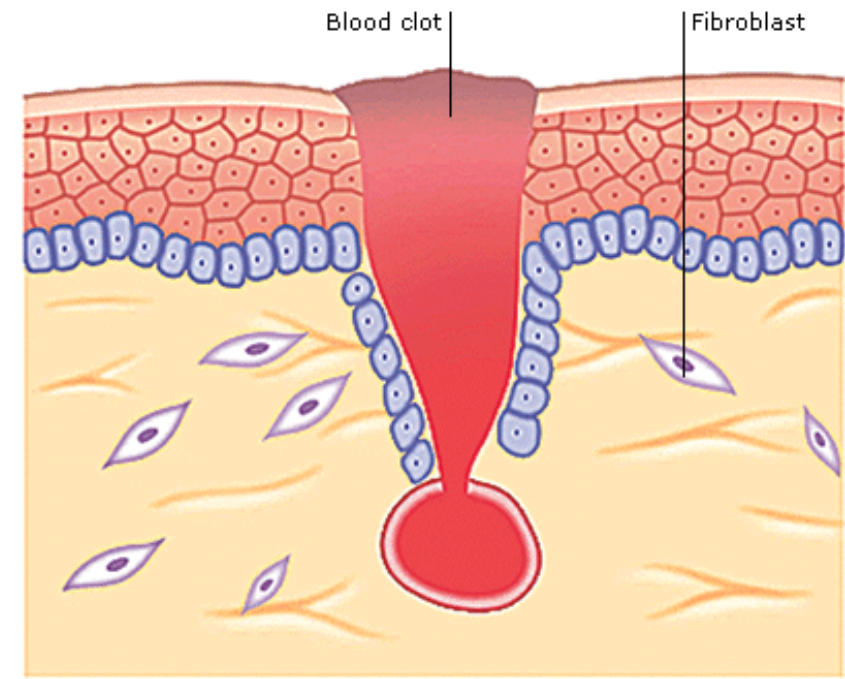
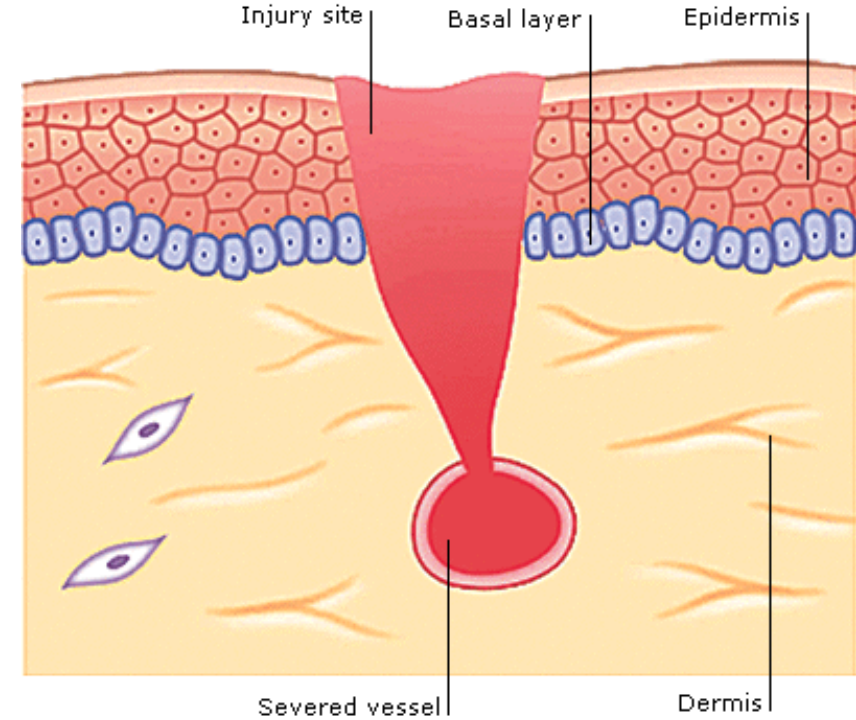
## Injury

1) The wound breaks open cells and releases their contents. These components attract various defense and repair cells.

## 2) Clotting

Blood seeps from the vessel and forms a clot.

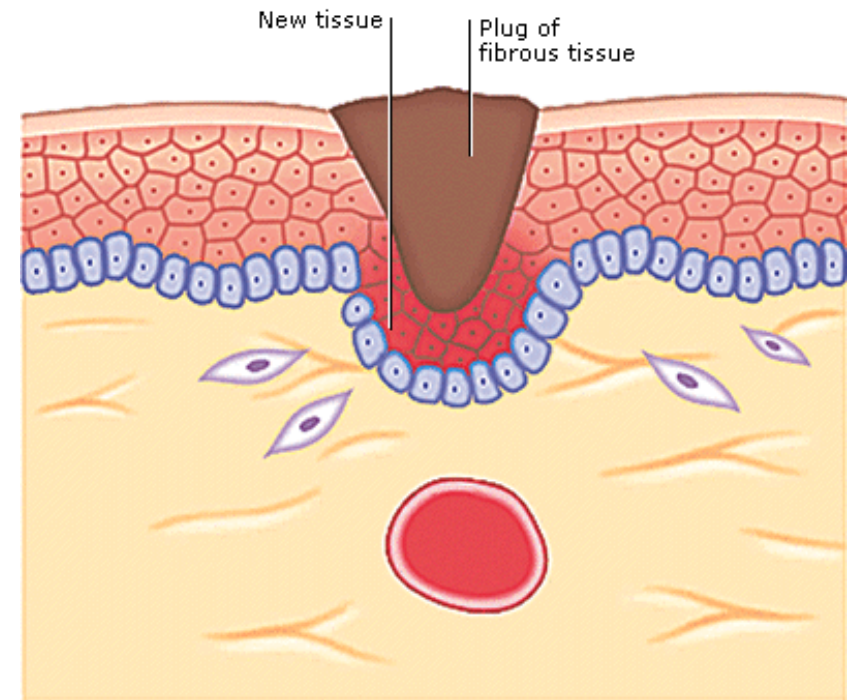
Fibroblasts multiply and migrate to the damaged area as do white cells called neutrophils, which ingest cell debris and foreign matter, such as dirt and germs.



### 3) Plugging

Fibroblasts produce a plug of fibrous tissue within the clot, which contracts and shrinks. New tissue begins to form beneath.

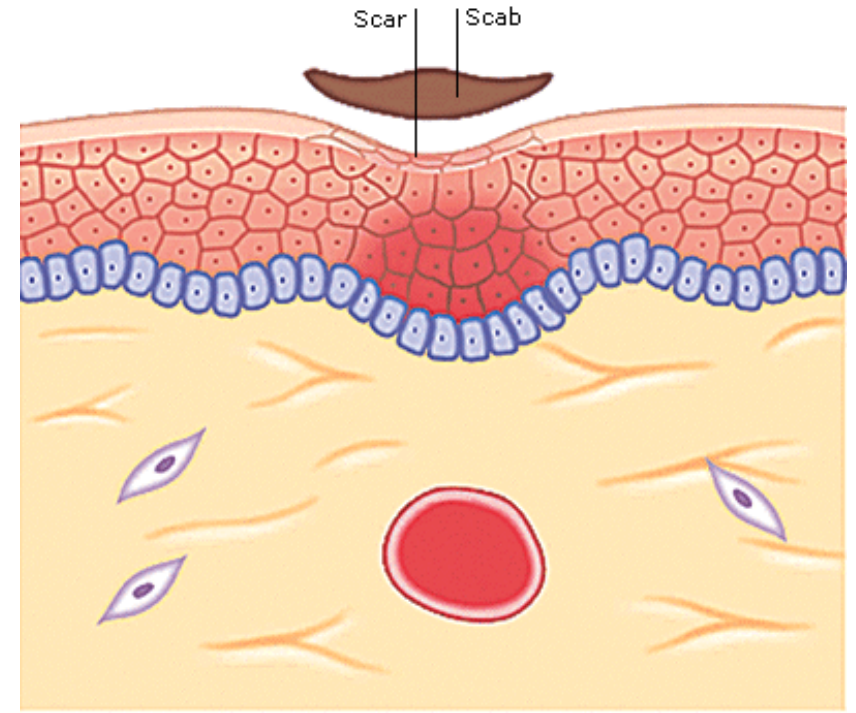
The clot gradually hardens and expels fluid to become a scab, as the tissues heal beneath.



### 4) Scabbing

The plug hardens and dries into a scab, which eventually detaches.

A scar may remain but usually fades with time.



# Ultraviolet defenses

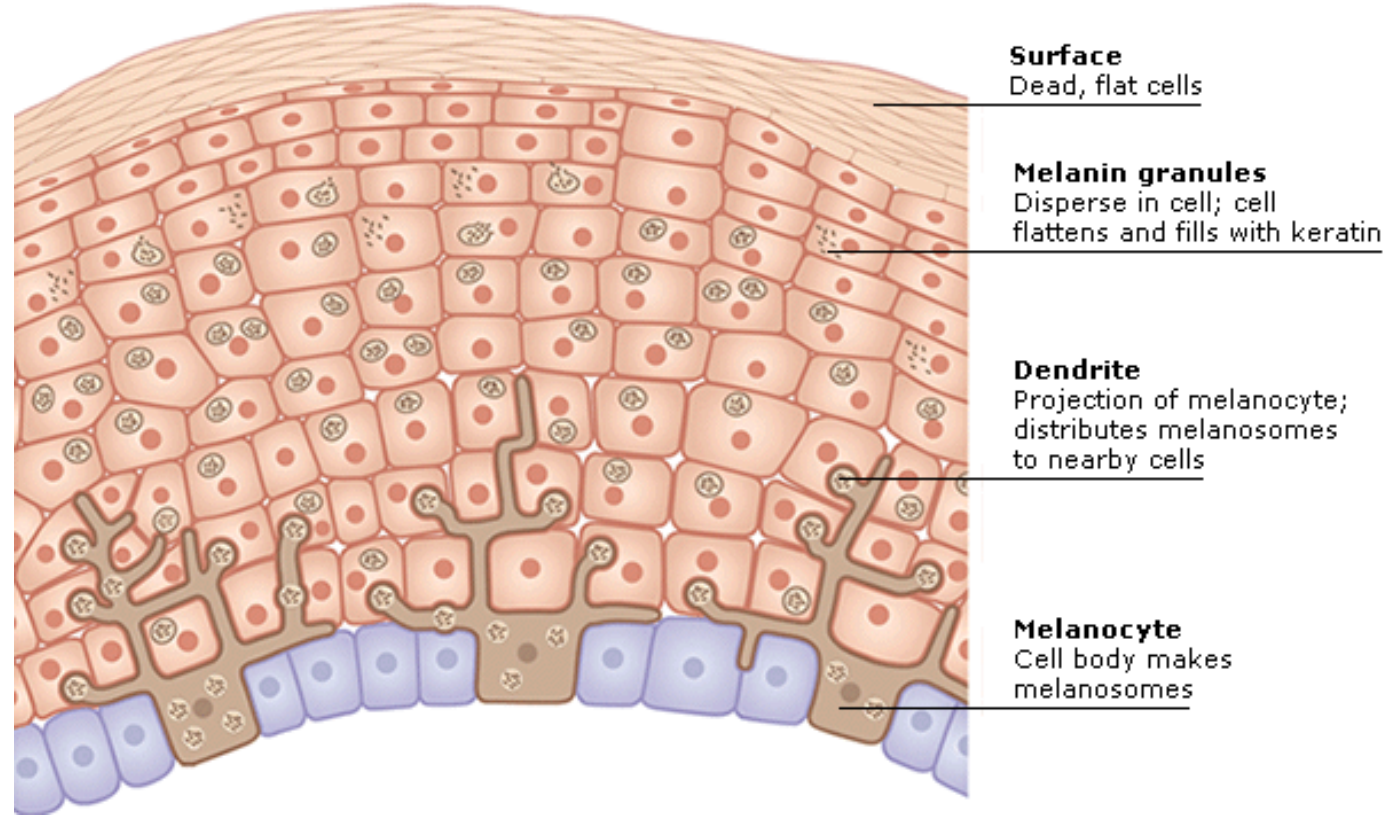
The Sun's rays include a spectrum of color wavelengths, including infrared or IR rays (the warming component) and ultraviolet, UV, rays.

Both UV-A and UV-B wavelengths are invisible to human eyes, but exposure to the latter, in particular, is linked to forms of skin cancer.

Skin's self-defense is its dark coloring substance, or pigment, melanin. This forms a screen in the upper epidermis that shields the actively multiplying cells in the base of the epidermis.

## Melanin production

Melanocytes are melanin-producing cells in the base of the epidermis. They make parcels of melanin granules, melanosomes, which pass into surrounding cells.



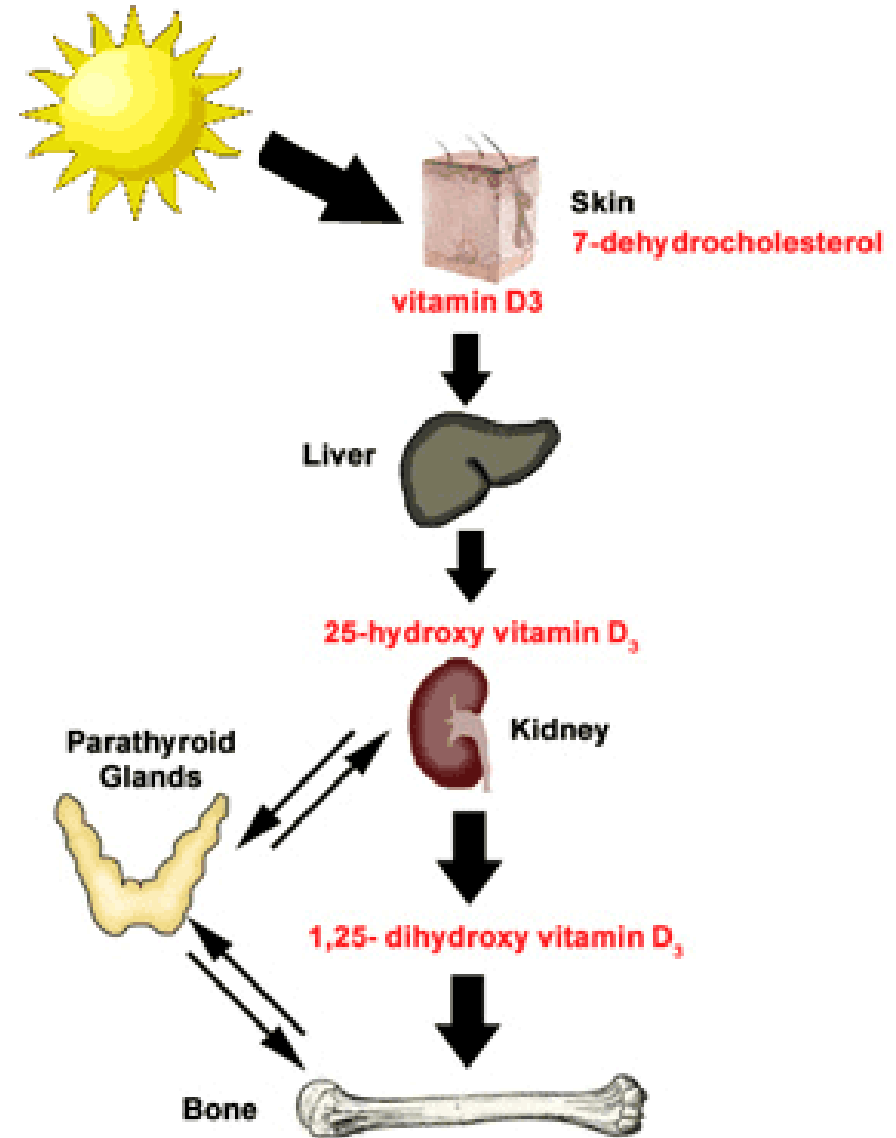
# GETTING VITAMIN D FROM SUNLIGHT AND FOODS

Our skin naturally contains a precursor to vitamin D.

When the sun's ultraviolet rays touch the skin, they convert the precursor to a molecule called vitamin D<sub>3</sub>, which then follows a metabolic pathway through the liver and finally to the kidneys, where it's converted into a molecule called calcitriol.

That's the good stuff—the active form. (Vitamin D obtained from food or supplements must also follow that metabolic pathway to become active.)

- ❖ Vitamin D is essential to healthy bones, because it helps you absorb calcium, which strengthens your skeleton.
- ❖ Without the vitamin, you could develop brittle bones, increasing the chance of getting osteoporosis when you're older.
- ❖ Children with insufficient vitamin D can develop soft bones, putting them at risk for rickets.
- ❖ Inadequate amounts of vitamin D can also lead to a weakened immune system.



# HAIR GROWTH

Hairs are rods of dead, flattened cells filled with keratin and have a mainly protective role.

The hair's root, or bulb, is buried in a pit, the follicle.

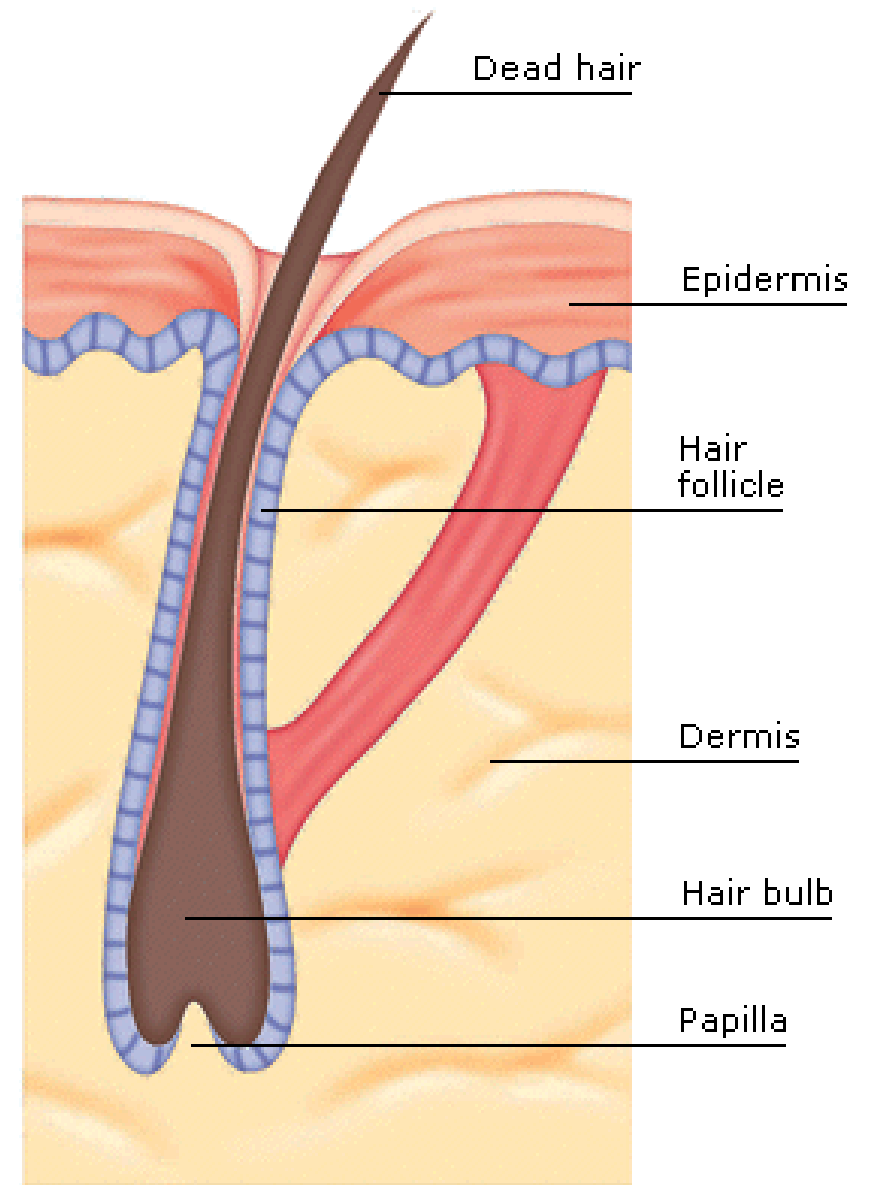
As extra cells add to the root, the hair lengthens from its base.

Different kinds of hairs grow at varying rates, with scalp hairs lengthening about 1/100 inch, each day.

**However, hair does not grow continuously.**

After three to four years, the follicle goes into a rest phase and the hair may detach at its base.

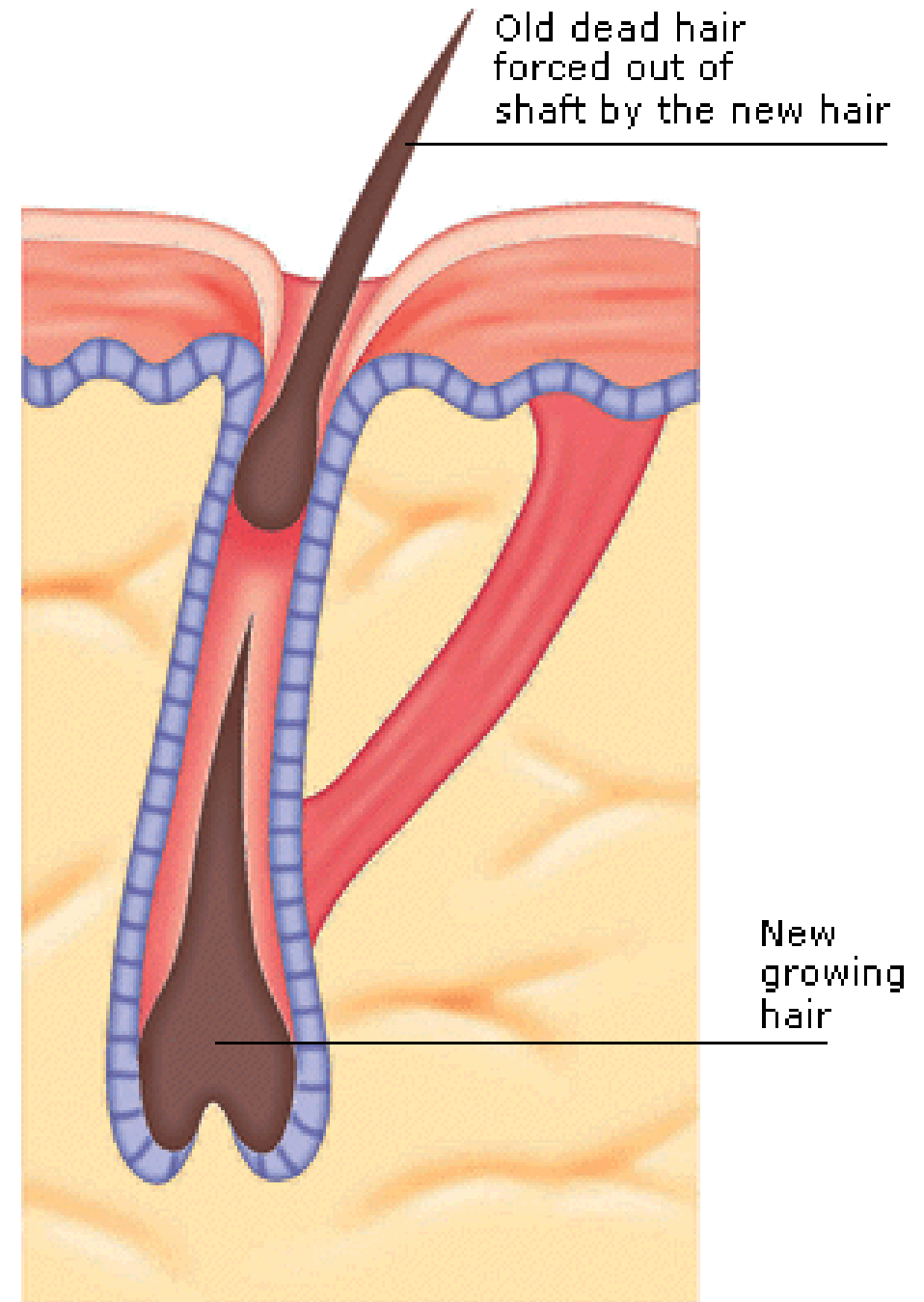
Three to six months later, the follicle activates again and begins to produce a new hair.



Rest phase - The hair grows to its maximum length. Activity in the follicle stops and the hair dies.

## Growth phase

A new hair sprouts at the base of the follicle. As it grows, the dead hair is shed.



**Temperature regulation - One of the skin's functions is to contribute to thermoregulation – maintenance of a constant body temperature.**

**It does this in three main ways:**

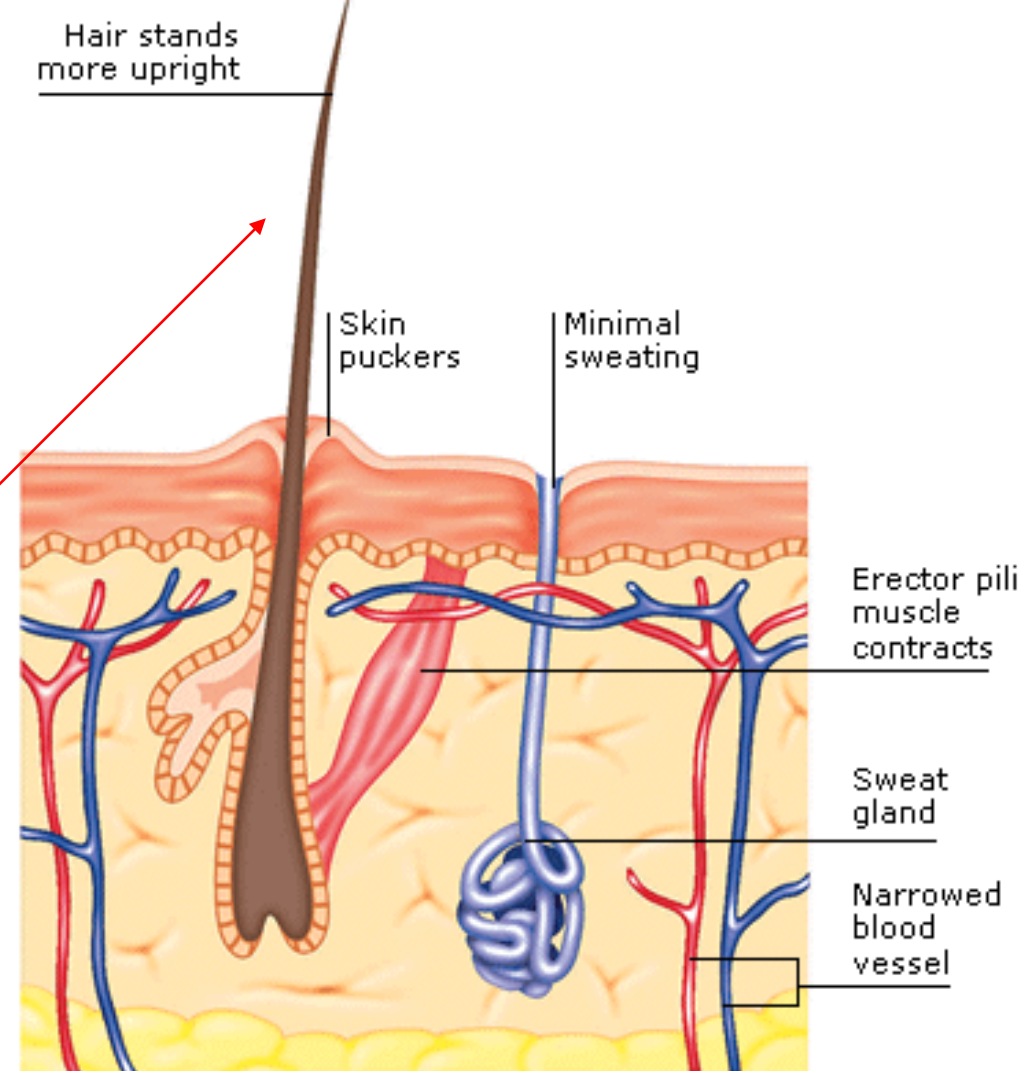
- ❖ Widening and narrowing of blood vessels
- ❖ Sweating
- ❖ Hair adjustment.

**If the body becomes hot, blood vessels in the dermis widen (vasodilate) to allow extra blood flow so more warmth can be lost from the surface.**

The skin may look flushed, and sweat oozes from sweat glands and evaporates, drawing away body heat.

**If the body is cold, the peripheral blood vessels narrow (vasoconstrict) to minimize heat loss, and sweating is reduced.**

**Tiny body hairs are pulled upright by the erector pili muscles to trap air as an insulating layer.**



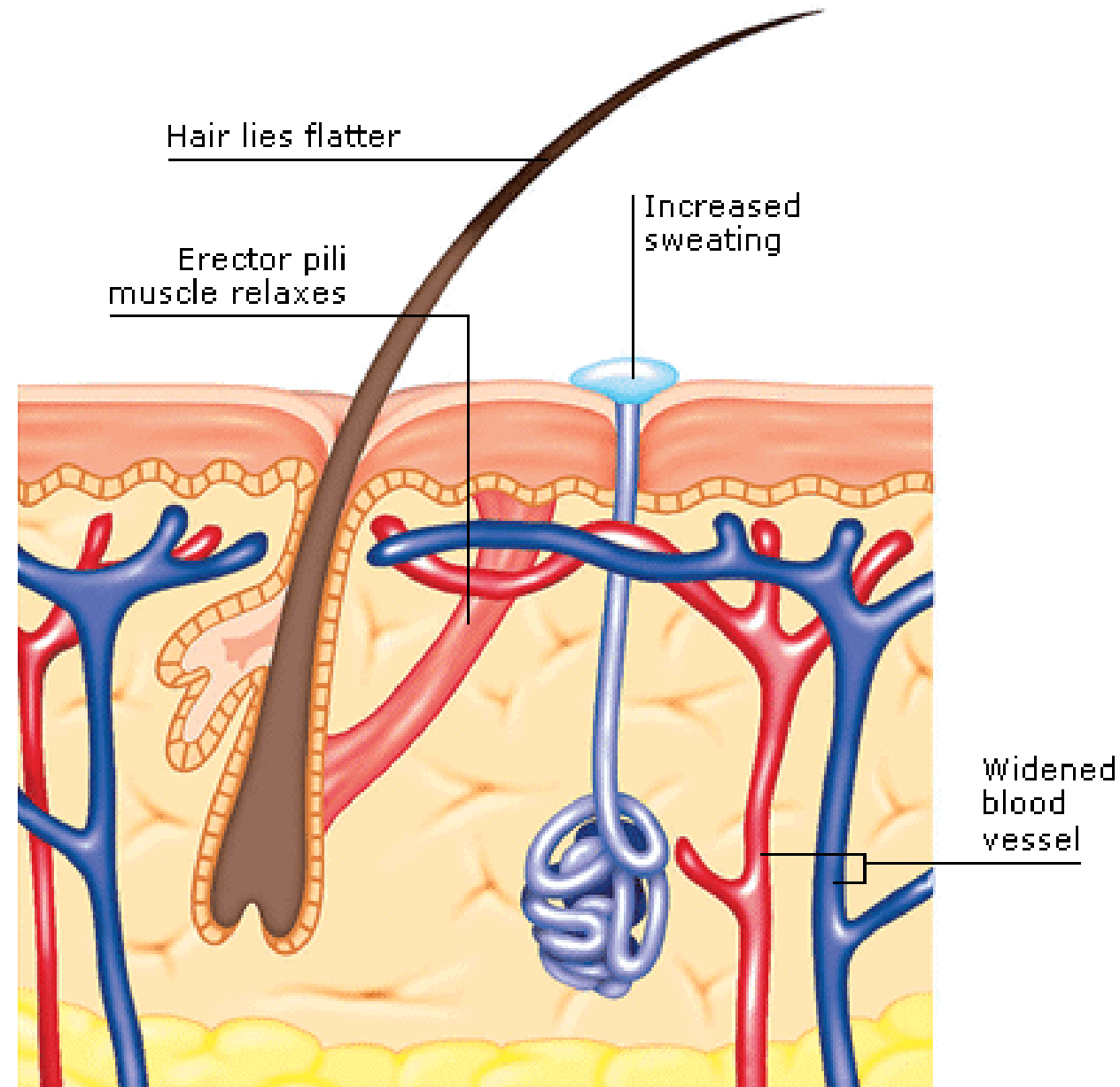
Feeling cold - Tiny body hairs, raised by contraction of the erector pili muscles, create small mounds known as goose pimples at their bases.

The peripheral blood vessels constrict, and sweat glands reduce their activity.

## Feeling hot

Tiny body hairs lie flatter as the erector pili muscles relax, and the small mounds at their bases disappear.

Dermal blood vessels dilate, increasing blood flow, and the sweat glands raise their output of sweat.







## **Eyebrows and eyelashes**

The arch of relatively coarse, fast-growing eyebrow hairs helps to divert sweat or rainwater on the forehead that might trickle into the eyes.

Eyelashes produce swirling air currents when blinking, which push floating particles away from the eye surface.



## **Scalp hair**

Head hairs help to keep rainwater from the scalp, absorb or deflect some of the energy in knocks and blows, and shield the head from extremes of temperature.

## Nail structure

Fingernails and toenails are hard plates made of a tough protein called keratin.

Growth takes place under a fold of flesh (cuticle) at the nail base.

An area called the nail matrix adds keratinized cells to the nail root, and the whole nail is continuously pushed forward along the nail bed towards its free edge.

Most nails grow about 1/50 inch each week, with fingernails lengthening faster than toenails.

